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SAN FRANCISCO RAINFALL.

July 1st, 1871, to June 30th, 1872.

| Day. | July | Aug | Sep. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | April | May. | June. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | .02 | .14 | | | | |
| 2 | | | | | | .16 | | .06 | | | | | |
| 3 | | | | | .19 | | .86 | .14 | | | | | |
| 4 | | | | | | | | .01 | .17 | | | .01 | |
| 5 | | | | | | | .17 | | .50 | | | | |
| 6 | | | | | | | .10 | | | | | | |
| 7 | | | | | | | .18 | .33 | | | | | |
| 8 | | | | | | | 2.35 | .89 | .11 | | | | |
| 9 | | | | | .03 | | .34 | .82 | .06 | | | | |
| 10 | | | | | | | | .21 | | | | | |
| 11 | | | | | | | .11 | .28 | .33 | | | | |
| 12 | | | | | | | .02 | | .13 | .05 | | | |
| 13 | | | | | .02 | | .02 | | | | | | |
| 14 | | | | | .18 | | | .10 | | | | | |
| 15 | | | | | .22 | | | .24 | | .35 | | | |
| 16 | | | | | | | | .29 | | .43 | | | |
| 17 | | | .01 | | | .63 | | .28 | | .08 | | | |
| 18 | | | | | | 3 22 | | .02 | | | | | |
| 19 | | | | | | 3.49 | | | | .01 | | | |
| 20 | | | | | | .62 | | | | | | | |
| 21 | | | | | | .93 | | .61 | | | | | |
| 22 | | | | | | .32 | | .44 | .02 | | | | |
| 23 | | | | | | 3.48 | | .76 | | | | | |
| 24 | | | | .02 | .35 | | | .41 | | | .03 | | |
| 25 | | | | | | | | .16 | | | | | |
| 26 | | | | | 1.67 | .15 | | | | .16 | | | |
| 27 | | | .02 | .09 | .13 | .74 | | .90 | .04 | .02 | | | |
| 28 | | | | | .93 | .23 | | | | | | | |
| 29 | | | | | | 1.04 | | | | | | | |
| 30 | | | | | | .13 | | | | | .02 | | |
| 31 | | | | | | 1.60 | .07 | | .14 | | .11 | | |
| Sum | | | 0.03 | 0.11 | 3.72 | 16.74 | 4.22 | 6.97 | 1.64 | 1.10 | 0.16 | 0.01 | 34.70 |

## ON THE DENTITION OF METALOPHODON.

### By Edward D. Cope.

(*Read before the American Philosophical Society, September* 20, 1872.)

This discovery of a second species allied to *Bathmodon*, Cope, represented by more complete remains of dentition than that on which that genus was originally established (*B. radians*), renders it possible to enlarge our knowledge of its characters.

It may be premised that the new species may belong to the group *Loxolophodon*, and, as its characters differ from those of the large species *Eobasileus cornutus*, *furcatus* and *pressicornis*, I must retain the last named genus with characters ascribed in my last paper to the former, and withdraw the species from the former, to which I at that time referred them. It appears that this name, used first for a section of *Bathmodon*, was, perhaps, based on mandibular teeth alone, which in *Metalophodon*, differ remarkably from the maxillaries. The cranium of the new species to be described was so decayed as to be irrecoverable, but the teeth obtained were in place, and in close proximity, so that there can be no reasonable doubt that they belong to the same animal.

The species differ considerably from the *B. radians*. The most prominent are: first, the failure of the lateral or straight limbs of the crescent of the tooth-crown to meet at the apex, in the molars proper; second, the presence of two lobed premolars only, the three lobed found n *Bathmodon* not being represented in any series. The first character appears to me to be of generic importance, hence the name applied to it at the head of this article. It may yet prove to be *Loxolophodon*, as no generic character distinguishes the inferior molars of the two. It remains however, to determine whether that name applies to *Bathmodon*, or a genus different from it, as the present. In the meantime the new species may be called *Metalophodon armatus*. It is as large as the Indian *Rhinoceros*, or perhaps larger.

The *incisors* are well developed, those of the premaxillary subequal in size. The crown has a convex cutting edge and flat inner face. The outer face is convex. In some the inner face is more concave, and is bounded by a cingulum next the root.

The *premolars* present a single external crescent of acuminate outline, and a smaller, more transverse one, within. A cingulum bounds the crown fore and aft, but is wanting at both base and apex of the triangular base. In the more posterior the crescent is more open, and the crown less transverse.

Tho *molars* present an increase in transverse extent of the external crescent, and the interior one is wanting. In the posterior two the anterior ridge curves round at the apex, but is separated by a considerable interruption, from the posterior. The latter is shortened, and terminates externally in a conic tubercle, which approaches the outer extremity of the anterior ridge. In the last molar the posterior ridge is shorter, nearly straight, and terminating in a cone at each extremity.

The *canine* is damaged, but was of large size, amounting in one or the other of the jaws to a tusk. The probably superior is compressed, with acute edges. The inner face gently convex, the outer more strongly so, with an acute ridge on its anterior convexity, inclosing an open groove, with the interior cutting edge. This surface of the dentine when exposed has a transversely wrinkled character, but no trace of engine-turning in the fractures.

In the *mandible*, premolar and molar teeth are recognizable; the character of the incisors remaining uncertain. As usual in ungulates, they possess a relatively smaller transverse diameter than do the corresponding teeth of the maxillary. They change very materially in form from the front to the terminus of the series, and in connection with the superior molars, are very instructive as to the genetic connection of different types of dentition.

The pecularity of the *premolars* consists in the fact that besides the single external crescent exhibited by those of the upper jaw, they have a rudimental second one in the position it should occupy in corresponding teeth of *Palæosyops*. The inner border of the crown is convex, and extends from apex to apex of the crescents. There are no cingula to these teeth. The rudimental crescent diminishes anteriorly, its angle becoming first obtuse, and then disappearing. Posteriorly the reverse process takes place, and proportions increase. But in the last *molars* they do not assume the proportions seen in *Palæotherium* and allied forms. They increase in the elevation of corresponding ridges of the crescents, and decrease in the others, so that the resultant form is nearly like that of *Dinotherium* or perhaps *Lophiodon*. The outer ridge of one crescent appears as a cingulum, which sinks to the base of the crown from the apex. This is rudimental in the genera just mentioned. The corresponding bounding ridge of the other crescent is reduced to a rudiment extending diagonally across the valley between the remaining crests, as is seen in not a few genera of the Eocene.

We have thus an explanation of the heretofore obscure question as to the origin of the crescent-bearing tooth of the Artiodactyles. From the two crested type of *Tapirus*, the two-angled form developes itself by the growth of the cingulum and diagonal crest just described. This is seen completed in *Palæosyops*. The elevation of the ridges and deepening of the intervening valleys, would result in the ordinary Ruminant type. The same process increasing transverse crests only, derives the *Mastodont* from the *Tapiroid* form, and the deepening of the valleys of this, again results in *Elephas*.

In comparison with *Bathmodon semicinctus*, Cope, the crowns of the premolars are of similar size, but considerably less elevated.

The measurements cannot be given with exactitude, but are approximately as follows: Superior incisor crown, width. 75 inch; elevation .60 inch. Canine 1.25 inches from apex, inner face .75 inch. Premolar length. 76, width 1.1 inch. Molar length crown 1.1 inch, width 1.25 inch. Inferior premolar, length of crown 1 inch, width .75 inch. Posterior molar, length 1.30 inch, width .9 inch. The crests of the last mentioned are quite elevated, one more than the other; the lower with a strong cingulum at the base, which rises to what is homologous with the base of a triangle, or outwards; none on the inner aspect of the base of the crown. The cingula of the superior molars are only anterior and posterior.

This large ungulate was found in a stratum below those of the Green River Group of Hayden, or in the lower beds of that series, near Black Buttes, Wyoming. Obtained by the Geological Survey under direction of Dr. F. V. Hayden.

In a line of banks or low bluffs, immediately below that in which the *Metalophodon* was found, dermal scutes of a small crocodilian are abundant. The discovery of the greater part of a cranium of one of these enables me to point out the existence of a species of Alligator of still smaller size than the smallest of the Caimans at present inhabiting South America. This species, which I call ALLIGATOR HETERODON, possess several peculiarities. The anterior and posterior teeth differ exceedingly in shape; the former are flattened, sharp-edged, and slightly incurved; the edges not serrate. Those of the premaxillary bone are subequal in size, while one behind the middle of the maxillary is larger than the rest. The posterior teeth have short, very obtuse crowns with elliptic fore and aft outline. They resemble some forms seen in Pycnodont fishes, and are closely striate to a line on the apex. The upper surface of the cranium is pitted, the frontal and parietal bones, with large, deep, and closely placed concavities. The former is perfectly plane, and the latter is wide. The squamosal arch is also wide, and the crotaphite foramina are large and open. The dermal scuta are very large for the size of the animal, and were not united by suture. They are keelless, and deeply pitted, with smooth margins.

The vertebral centra found with other specimens are round. The coössified neural arches indicate the adult age of the animal.

MEASUREMENTS.

| | | M. |
|---|---|---|
| Height crown premaxillary tooth | | .004 |
| Width " " at base | | .0035 |
| Long diameter crown of a maxillary | | .005 |
| Short " " " | | .0035 |
| Width parietal | | .009 |
| Width frontal | posterior | .020 |
| | interorbital | .010 |
| Width molar below eye | | .008 |

The variation in the form of the teeth is a slight exaggeration of that seen in the dentition of various species of crocodilians.

## *Stated Meeting, Oct. 4th,* 1872.

Present, 20 members.

Vice-President, Mr. Fraley, in the chair.

A letter, accepting membership, was received from the Rev. S. H. Nichols, dated 415 South Fifteenth Street, Philadelphia, September 26th, 1872.

An engraved portrait of William Smith, D.D., first Provost of the College of Philadelphia, was presented by Mr. Horace W. Smith.

A circular letter, announcing the death of Signor Felice Finzi, dated Firenze, 4th September, 1872, was received from his relatives.

A letter of envoy and acknowledgment (Proc. 81 to 85) was received from the Geological Society of St. Petersburg.

Donations for the library were received from the Revue Politique; the Meteorological Committee of the London R.